National Aeronautics and Space Administration

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SPACE LAUNCH SYSTEM HIGHLIGHTS

We have Ignition: SLS RS-25 Engine Fires Up for Two More Tests in Series

The RS-25 engine fires up at the beginning of a 500-second test June 11 at NASA's Stennis Space Center near Bay St. Louis, Mississippi. This is the third firing of an RS-25 development engine on the A-1 test stand at Stennis. For the full story, click **here**. *(NASA/Stennis)*

RS-25 completed its longest test yet of the series June 25. This is the fourth firing of the RS-25. Watch a video of it **here**. *(NASA/Stennis)*

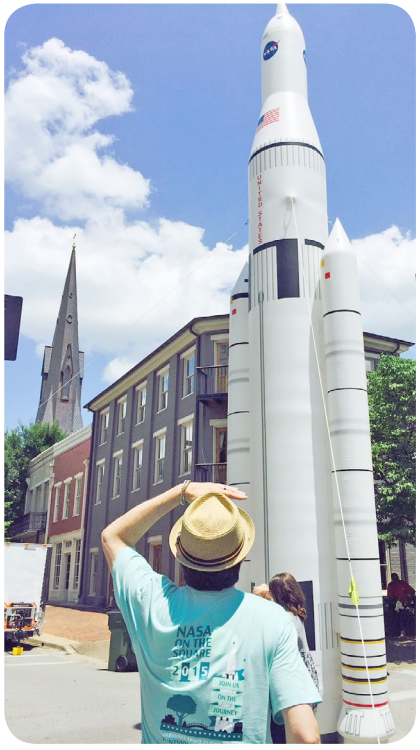
Selective Laser Melting Can Cut Time, Costs for SLS RS-25 Engine Parts

Marshall Center engineers Jim Lydon, left, and Zach Jones work on a recently 3-D printed rocket part. *(NASA/MSFC)*

Andy Hardin, a subsystems manager in the Liquid Engines Office at NASA's Marshall Space Flight Center in Huntsville, Alabama, inspects a 3-D printed rocket part made with a selective-laser-melting machine in the Advanced Manufacturing Lab. Selective laser melting, a 3-D printing process, is being used to make some of the parts more efficiently and affordably — without compromising performance and safety — for the RS-25 engine and other components of SLS. Full story **here**. *(NASA/MSFC)*

SLS Inspires at NASA on the Square

SLS was part of the second-annual NASA on the Square June 20 in downtown Huntsville, Alabama. Huntsville is home to NASA's Marshall Space Flight Center, where the SLS Program is managed for the agency. Hundreds of visitors came out to Huntsville's historic courthouse square to learn more about space exploration, SLS, Orion and the agency's Journey to Mars. *(All photos NASA/MSFC)*



Spaceflight Partners: LNT Powdered Metal Inc. and Synertech Powdered Metal Inc.

EDITOR'S NOTE: Every month, Space Launch System Highlights turns the spotlight on one of the many industry partners helping to create the largest rocket ever built for human space exploration. In this issue, we profile profile LNT Powdered Metal Inc. and Synertech Powdered Metal Inc., both of Garden Grove, California.

Synertech Powdered Metal Inc. is working with engines prime contractor Aerojet Rocketdyne and LNT Powdered Metal Inc. on creating manufacturing processes that can reduce costs for the RS-25 engine. *(Synertech)*

LNT Powdered Metal Inc. — through a joint venture with Synertech Powdered Metal Inc. — is an international leader in the development and manufacturing of powdered-metal products through Hot Isostatic Pressing (HIP). Powdered metal is placed into a mold that is subjected to high temperature and pressure which results in a precise shaped part with excellent properties.

Leveraging a long-term teaming arrangement with Aerojet Rocketdyne of Sacramento, California, LNT and Synertech are working to lower the cost of future RS-25 engines. These engines power the SLS core stage. LNT and Synertech's Selectively Net Shape Hot Isostatic Pressing process allows the manufacture of large-sized, critically loaded components from advanced powder alloys that are not available through the traditional cast and wrought route.

This technology allows complex-shaped components, once fully machined from forged billets, to be fabricated without complex machining, welding or casting while retaining mechanical properties equal to or exceeding the conventional forged and machined product. This ultimately results in a lower-cost, higher-reliability product.

Aerojet Rocketdyne, LNT and Synertech, building on technology tested by NASA and the U.S. Air Force, are developing Selectively Net Shape turbo machinery and valve components for RS-25. This effort is part of the ongoing work to create the largest rocket ever built that is sustainable and affordable.

Added Support in the Middle for SLS Booster Qualification Test

The ground test of the five-segment booster qualification motor, QM-1, for SLS was a huge success. In part, it was a success because NASA and Orbital ATK got the support where needed — literally. Increasing the length from a shuttle-era, four-segment motor to five segment for SLS required a mid-span support to decrease the sag in the motor. The five-segment development test motors each used one mid-span support to decrease motor sag. QM-1 used two mid-span supports to further decrease motor sag — more closely simulating a vertical flight motor.

When Orbital ATK determined the need for a second mid-span support, they contracted with the same vendors that fabricated the first support. These long-standing partners had the proven expertise that provided some clear benefits in fabricating a duplicate tool, including reduced cost and improved fabrication timeline.

The three major vendors for mid-span support include Major Tool & Machine of Indiana; Force Measurement Systems (FMS) of California; and Specialized Analysis Engineering (SAE) of Logan, Utah. All three vendors maintained an open line of communication with Orbital ATK tooling engineers and communicated via e-mail or telephone almost daily. Their communication and commitment to maintain focus allowed the team to react in real time to engineering and fabrication concerns. Each vendor had a dedicated person responsible for overseeing Orbital ATK's tool and staying on schedule.

Major Tool & Machine fabricated the metal structures of the mid-span support for the QM-1 static test motor. These structures include two uprights bolted to the bay floor and a massive structure that spans the width of the static test motor and supports the weight taken up by the slings during build-up and testing.

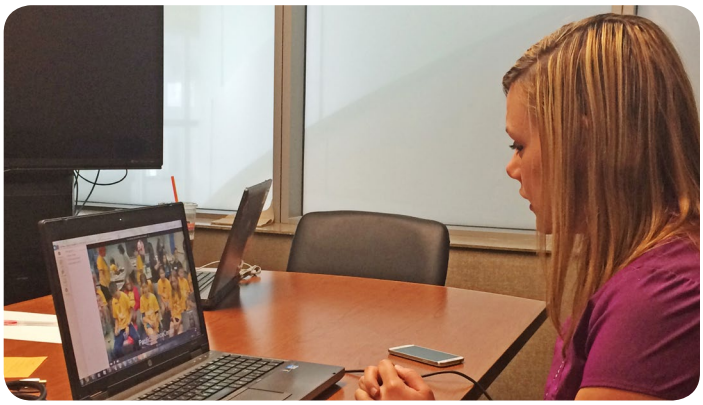
"These three suppliers have a long-standing history with Orbital ATK and have once again demonstrated their value as a deserving partner. We appreciate their ability to perform as necessary," said Fred Brasfield, vice president of Orbital ATK NASA Programs. "These vendors have supplied the components and structures needed to help us acquire necessary data from our test motors."

Because of industry partners like these, the SLS booster is being built affordably and efficiently, and will incorporate new and innovative processes and materials.

Industry partners Major Tool & Machine; Force Measurement Systems; and Specialized Analysis Engineering were an integral part of the success of the March 11 SLS booster qualification test. (Orbital ATK/Spaceflight Insider)

On the Road...

SLS Program Manager Todd May talks about the rocket and the Journey to Mars at the Huntsville Association of Technology Societies annual "Professionals of the Year" awards on June 18 at The Westin Hotel in Huntsville, Alabama. (NASA/MSFC)



SLS engineer Kathryn Crowe talks about the rocket and NASA's Journey to Mars on June 23 with more than 30 students via webchat from the Pacific Science Center in Seattle. *(NASA/MSFC)*

A future explorer draws the SLS at "Take Our Children to Work Day" on June 18 at the Marshall Center. *(NASA/MSFC)*

SLS on Deck:

- SLS critical design review board
- EM-1 Interim Cryogenic Propulsion Stage production starts
- RS-25 engine testing continues at Stennis

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